peratures, and snow, but the central barometric readings, which were at no time low, except by comparison with the surrounding highs, suddenly rose, and on the 29th, a. m., had become a trough with a pressure of about 30.05 in western New York and Pennsylvania. On the 29th, p. m., however, as this trough passed to the Atlantic Ocean, it developed into a storm center that moved northeastward, and, on the 30th, a. m., was central between Newfoundland and Cape Breton.

Information signals were ordered on the 27th, 10 p. m., at Corpus Christi and Galveston, Tex., and northwest signals on the 28th, 1.30 p. m., at the same places; on the same date, at 10 p. m., northwest signals were ordered from Port Eads, La., to Pensacola, Fla., and on the 28th, 10.40 a. m., southeast wind signals at Grand Haven, Mich.

XXI.—On the 28th, p. m., low pressures developed on the Pacific coast, both in the Gulf of California and in British Columbia. The latter moved eastward, reaching Manitoba on the 30th, a. m., and Minnesota on the 30th, p. m., after which it turned northeast and passed through Canada north of our stations, but accompanied by high southwest winds over the Lake region on the 31st.

On the 30th, p. m., information signals were ordered for Grand Haven, Mich., and on the 31st, 10.30 a. m., northwest signals for the same place.

NORTH ATLANTIC METEOROLOGY.

[*Pressure in inches and millimeters; wind-force by Beaufort scale.*]

The normal barometric pressure for March over the North Atlantic Ocean, as deduced from international simultaneous observations, is highest, 30.10 to 30.16 (764 to 766), in a belt extending from the west coast of Africa into Florida, between parallels N. 20° to N. 30°; a corresponding belt prevails on the Pacific Ocean west of the peninsula of lower Florida. The region of lowest pressure, 29.65 to 29.70 (752 to 754), includes Iceland and the southern end of Greenland; a still lower area of low pressure apparently exists between North Cape and Nova Zembla; in the Pacific Ocean the lowest pressure extends from the southern point of Alaska westward over the Aleutian Islands. An area of high pressure between the Rocky Mountains and Hudson Bay, and connected with the high pressure of northern Siberia, separates the low areas of the Atlantic and the Pacific. The general distribution of the pressure is, therefore, symmetrical, not with respect to the north pole and the equator, but rather to a line drawn from Manitoba to the Sea of Baikal, in Siberia. These pressures are as given by the mercurial barometer, uncorrected for the variation of gravity with latitude.

As compared with February the normal pressure for March is lower by 0.10 in Manitoba, Assiniboia, and Saskatchewan, as also along the middle and east Atlantic coasts to Newfoundland and the mouth of the St. Lawrence, but it is higher by 0.15 over Greenland, Iceland, Ireland, Spitzbergen, and the intermediate ocean.

The departures of normal monthly pressure for March from the annual normals for the Northern Hemisphere show a deficit of 0.10 over the Atlantic southeast of Nova Scotia and Newfoundland, and, therefore, decidedly south of the region of lowest pressure; this location to the southward is, to a considerable extent, explained as the effect on the mercurial barometer of the variations of gravity with latitude.

The tracks pursued by storm centers, as well as their average velocity and frequency, differ but little from those of February. The regions over which the greatest number of storm centers pass are as follows: 43 near Lake Superior; 44 between Cape Cod and Nova Scotia; 34 east of Newfoundland, at about N. 47°, W. 45°; 20 between Iceland and the Orkneys; also in northern Norway and Sweden and in central Italy. The average velocity of movement for the United States is 33 miles per hour, and for the North Atlantic Ocean 22 miles from west to east. On the average one storm traverses successively both the North American continent, the Atlantic Ocean, and Europe during the month of March.

NORTH ATLANTIC STORMS.

The paths of the following areas of low pressure and strong winds on the Atlantic Ocean during March, 1894, have been approximately traced on daily charts of simultaneous observations received through the co-operation of the Hydrographic Office, U. S. Navy, and the "New York Herald Weather Service:"

A. Central, 1st, Greenwich noon, N. 60°, W. 8°, and was a continuation of area *L* in the series for February. Pressure was at this time high over southern Europe and the entire Atlantic south of N. 45°, and continued high in the eastern portion of this region for several days; 2d, noon, central N. 62°, W. 4°; 3d, noon, N. 65°, E. 22°; 4th, noon, N. 65°, E. 50°; the central lowest pressure had by this time steadily risen, and having passed into the region of the Ural Mountains, was probably entirely broken up.

B. This represents the western portion and a subdivision of area *A*, and probably originated on the 3d south of Iceland, and in the usual manner by the inflow of cold, northwest winds into the southwest end of a general depression; it was central, 4th, noon, at N. 62°, W. 5°; 5th, noon, in southern Sweden and the Baltic Sea, where it disappeared.

C. This was a continuation of U. S. series No. II. On the 2d a depression existed between the Atlantic coast and Bermuda, approximate location of its center, N. 32°, W. 32°; 3d, noon, N. 42°, W. 57°; by this time it had developed into a severe hurricane; 4th, noon, N. 43°, W. 52°; 5th, noon, the center had apparently rapidly filled up and only a slight depression was left at N. 44°, W. 48°, while a more important trough of low pressure was developing to the northward. The *Edam*, at 7 p. m., was at N. 41° 47′, W. 57° 21′, barometer 28.92.

D. This depression was central on the 6th, noon, at N. 60°, E. 2°, and on the 7th, noon, at the southern end of the Baltic, N. 54°, E. 15°. At this time there was a series of five depressions and cyclonic whirls extending from the Baltic to the coast of British Columbia.

E. 7th, noon, N. 58°, W. 20°; 8th, noon, N. 60°, W. 10°; 9th, noon, N. 60°, W. 10°; 10th, noon, N. 60°, W. 10°; 11th, noon, N. 59°, W. 8°; 12th, noon, N. 63°, E. 4°; here this special whirl and depression seems to have broken up on the coast of Norway while, at the same time, on its immediate western side a new one (*F*) developed over Scotland.

F. 13th, N. 60°, W. 2°; 14th, N. 64°, E. 6°; 15th, N. 70°, E. 20°. Simultaneously with the development of *F* the general barometric depression extended rapidly southward into the Mediterranean, and on the 14th, 15th, 16th, and 17th, a minor depression passed from Corsica eastward to the Baltic.

G. This was a continuation of low area No. VII, U. S. series, which was in British Columbia on the 7th and at the mouth of the St. Lawrence on the 12th, where it probably broke up and a new area formed at the southern extremity, whose center, on the 13th, noon, was at N. 42°, W. 62°; 14th, about N. 46°, W. 55°, after which this center was broken up and merged into the following one.

H. A continuation of U. S. series No. IX, and was central

in Minnesota on the 12th and in New England on the 14th; 15th, St. Johns, N. F., N. 48°, W. 56°; 16th, N. 50°, W. 40°; 17th, N. 56°, W. 30°; 18th, near Iceland; 19th, near North Cape.

I. This was a continuation of U. S. series No. XII, which was central in the Dakotas on the 14th, and, on the 16th, was in Ontario, at about N. 48°, W. 75°; 17th, N. 48°, W. 49°; 18th, N. 52°, W. 37°; 19th, N. 55°, W. 30°; 20th, N. 58°, W. 25°; 21st, near Iceland; 22d, near North Cape; 23d, beyond North Cape and apparently turning southeastward. On the 17th, at 10.25 p. m., the steamer *La Campine* was near the center of this storm, having pressure 29.40, wind northwest, force 11.

J. A continuation of U. S. series No. XIII, which was central in British Columbia on the 15th and in the valley of the St. Lawrence on the 19th; 20th, noon, N. 48°, W. 50°; 21st, N. 49°, W. 37°; 22d, noon, N. 53°, W. 26°; after which it appears to have broken up, and an extensive area of high pressure developed over Europe and the adjacent portion of the Atlantic. The following vessels passed near the center of this storm: *La Campine*, at N. 43°, W. 46°, 21st, 2.30 a. m., barometer 28.90, wind north, force 11; *Stockholm City*, N. 47°, W. 38°, 21st, noon, barometer 28.95, wind north-northwest, force 11; *Doubledam*, N. 46°, W. 37°, 21st, 1 p. m., barometer 29.03, wind west-southwest, force 11; *Massasoit*, N. 48°, W. 32°, 21st, 7.30 a. m., barometer 29.22, wind west, force 11.

K. This was a continuation of U. S. series No. XVI, and represents that branch that seems to have developed over New England and the adjacent coast on the night of the 21st–22d; it was central on the 22d at N. 44°, W. 60°; 23d, N. 46°, W. 39°; 24th, N. 49°, W. 39°; 25th, N. 51°, W. 35°; 26th, N. 54°, W. 31°, after which it moved northward beyond our reports and probably was overtaken by and united with the following storm. The following vessels passed near the center of this storm: *Sorrento*, N. 43°, W. 57°, 22d, 11.30 p. m., barometer, 28.65, wind northwest, force 12; *Ocampo*, N. 40°, W. 56°, 22d, 4 p. m., barometer 29.27, wind northwest, force 11; *Hestia*, N. 44°, W. 39°, 23d, 6 a. m., barometer 28.36, wind west, force 12; *America*, N. 46°, W. 40°, 23d, 2.20 p. m., barometer 28.26, wind south-southeast, force 11; *Carthagenian*, N. 45°, W. 41°, 23d, 11 a. m., barometer 28.17, wind northwest, force 11; *Stockholm City*, N. 45°, W. 43°, 23d, 10 a. m., barometer 28.23, wind northwest, force 12; *Bengore Head*, N. 47°, W. 42°, 23d, noon, 28.34, wind northwest, force 12; *British Empire*, N. 46°, W. 40°, 23d, 1 p. m., barometer 28.44, wind north-northwest, force 11; *Temple More*, N. 49°, W. 32°, 25th, noon, barometer 28.65, wind southwest, force 9; N. 48°, W. 33°, 26th, 8 p. m., barometer 28.83, wind west-northwest, force 12. This storm was one of exceptional severity.

L. This was a continuation of No. XVIII of U. S. series, which was central over Lake Superior on the morning of the 24th, and in the St. Lawrence Valley on the morning of the 25th, while a minor depression, No. XIX, was central off the south Atlantic coast; the latter seems to have developed more rapidly than the former, and on the 26th, noon, a narrow trough stretched from Newfoundland southwest; 27th, N. 50°, W. 54°; 28th, both areas *K* and *L* had pushed north of our reports, and the extensive area of high pressure, U. S. series No. XVII, that had been moving southeastward over the North American continent since the 23d, now extended eastward over the Atlantic from Nova Scotia southward to the West Indies.

M. This was a continuation of U. S. series No. XX, which developed on the 28th and 29th off the coast of the middle Atlantic States and grew rapidly; it was central on the 30th at N. 46°, W. 58°; 31st, approximately, N. 52°, W. 36°. Among the vessels near the center of this storm were: *Temple More*, N. 42°, W. 55°, 30th, 8 a. m., barometer 29.00, wind north-northwest, force 12; *Schiedam*, N. 44°, W. 43°, 30th, 11.15 p. m., barometer 29.19, wind west-northwest, force 12; *Stockholm City*, N. 44°, W. 58°, 30th, 3 a. m., barometer 29.15, wind west-northwest, force 9.

WATERSPOUTS AT SEA.

Three waterspouts were observed off Cape Hatteras, N. C., in the afternoon of March 10, by Capt. Caull of the steamship *Castilian Prince*.

REMARKABLE OCEAN WAVES.

The remarkable heavy seas met with by steamers between America and Europe merit a special study. In certain circumscribed regions the interference and combination of different sets of waves giving rise to the great destructive wave may have some definite relation to the trend of the shore line, the location of the storm track, the general tide wave, and the depth of the ocean, such as will be elucidated by the collection and comparison of the observed phenomena.

The steamer *Teutonic* met a gigantic wave that swept over the vessel on Monday, March 26, while steaming westward.

OCEAN FOG FOR MARCH, 1894.

The limits of fog belts west of the fortieth meridian, as reported by shipmasters, are shown on Chart I by dotted shading. East of the fifty-fifth meridian fog was reported on 15 dates; between the fifty-fifth and sixty-fifth meridians on 8 dates; and west of the sixty-fifth meridian on 14 dates. Compared with the corresponding month of the last six years, the dates of occurrence of fog east of the fifty-fifth meridian numbered 10 more than the average; between the fifty-fifth and sixty-fifth meridians, about the average; and west of the sixty-fifth meridian, 9 more than the average.

OCEAN ICE IN MARCH, 1894.

The following table shows the southern and eastern limits of the region within which icebergs or field ice were reported for March during the last 13 years:

Southern limit.			Eastern limit.		
Month.	Lat. N.	Long. W.	Month.	Lat. N.	Long. W.
	° ′	° ′		° ′	° ′
March, 1882	42 20	50 00	March, 1882	46 30	46 00
March, 1883	41 46	49 48	March, 1883	48 40	43 03
March, 1884	41 20	54 06	March, 1884	45 00	40 15
March, 1885	40 55	49 04	March, 1885	45 57	43 15
March, 1886	40 20	49 02	March, 1886	47 20	44 40
March, 1887	41 00	49 07	March, 1887	45 31	42 56
March, 1888	42 30	50 37	March, 1888	47 23	46 56
March, 1889	44 20	53 00	March, 1889	44 20	53 00
March, 1890	41 01	50 54	March, 1890	46 40	39 50
March, 1891	42 25	50 30	March, 1891	49 00	43 44
March, 1892	43 58	48 15	March, 1892	43 58	48 15
March, 1893	44 35	50 13	March, 1893	45 55	46 56
March, 1894	40 20	49 36	March, 1894	46 25	42 30
Mean	42 05	50 07	Mean	46 23	44 43

The limits of the region within which icebergs or field ice were reported for March, 1894, are shown on Chart I by crosses. The southernmost ice reported, an iceberg and a field of ice noted on the 25th, was about 2° south of the average southern limit, and the easternmost ice observed, two large icebergs and many detached pieces of ice in a radius of four miles, noted on the 2d in the position given in the table, was about 2¼° east of the average eastern limit of ice for March.

An unusual amount of ice for March was reported during the current month. On the 14th, in N. 42° 20′, W. 51° 33′, a berg 90 feet high and 1,000 long was observed; also, on the 20th, N. 44° 18′, W. 48° 42′, a berg 100 feet high and 1,000 feet long was noted. Field ice was encountered near the eastern and southeastern edges of the Grand Banks of Newfoundland on the 12th, 13th, 20th, and 24th. Field ice was noted near Cape Breton Island and eastern Nova Scotia on

the 19th and 24th. The British steamship *State of Georgia* met field ice on the 13th in N. 48° 22′, W. 48° 48′, but did not clear it for five days, her progress being greatly impeded, and the plates of the vessel damaged. On the 17th the British bark *Armenia* collided with an iceberg in N. 44°, W. 48°; no report of the damage.

TEMPERATURE OF THE AIR.

[*In degrees Fahrenheit.*]

The distribution of the monthly mean temperature of the air over the United States and Canada is shown by the dotted isotherms on Chart II; the lines are drawn over the high irregular surface of the Rocky Mountain plateau, although the temperatures have not been reduced to sea level, and the isotherms, therefore, relate to the average surface of the country occupied by our observers; such isotherms are controlled largely by the local topography, and should be drawn and studied in connection with a contour map.

NORMAL TEMPERATURE.

In Table II, for voluntary observers, the mean temperature is given for each station, but in Table I, for the regular stations of the Weather Bureau, both the mean temperatures and the departures from the normal are given for the current month. In the latter table the stations are grouped by geographical districts, for each of which is given the average temperature and departure from the normal; the normal for any district or station may be found by adding the departures to the current average when the latter is below the normal and by subtracting when it is above.

DEPARTURES FROM NORMAL TEMPERATURE.

As compared with the normal for this month temperatures were in excess over the entire country east of the Rocky Mountains, but were deficient over the Rocky Mountain and Pacific coast region; the line of no departure extends from central Assiniboia southward through the eastern boundary of Wyoming and central Colorado to the southeastern portion of New Mexico. The maximum excess was from 10 to 12 over Lake Huron and the northern portion of Lake Michigan. The maximum deficits were: Helena, Mont., 3.2; Calgary, Alberta, 3.0; Edmonton, Alberta, 6.6; San Diego, Cal., 4.4; and Portland, Oreg., 4.5, with a rather smaller deficit at intermediate places.

The following table shows for certain stations, as reported by voluntary observers, (1) the normal temperature for March for a series of years; (2) the length of record during which the observations have been taken, and from which the normal has been computed; (3) the mean temperature for March, 1894; (4) the departure of the current month from the normal; (5) the extreme monthly means for March and the years of their occurrence during the period of observation:

State and station.	(1) Normal for the month of Mar.	(2) Length of record.	(3) Mean for Mar., 1894.	(4) Departure from normal.	(5) Extreme monthly means for March.			
					Highest.	Year.	Lowest.	Year.
Arizona.	°	*Years*	°	°	°		°	
Fort Apache	46.0	22	43.3	− 2.7	53.8	1879	41.3	1875
Fort Mohave	63.6	23	.....	.....	70.5	1879	58.0	1880
Whipple Barracks	45.4	22	41.9	− 3.5	53.8	1879	38.7	1886
Arkansas.								
Keesees Ferry	47.7	12	52.8	+ 5.1	55.4	1882	45.0	1891
California.								
Riverside	56.2	12	54.2	− 2.0	61.6	1885	51.5	1893
Colorado.								
Las Animas	40.0	12	42.9	+ 2.9	45.4	1887	33.2	1891
Florida.								
Merritts Island	66.0	12	69.7	+ 3.7	71.4	1882	61.6	1889
Georgia.								
Forsyth	56.7	20	62.8	+ 6.1	62.8	1894	51.4	1885
Idaho.								
Boise Barracks	43.0	20	41.0	− 2.0	49.1	1889	36.8	1882
Fort Sherman	38.2	10	35.0	− 3.2	43.6	1889	33.2	1882

Departures from normal temperature—Continued.

State and station.	(1) Normal for the month of Mar.	(2) Length of record.	(3) Mean for Mar., 1894.	(4) Departure from normal.	(5) Extreme monthly means for March.			
					Highest.	Year.	Lowest.	Year.
Indiana.	°	*Years*	°	°	°		°	
Lafayette	36.0	14	45.3	+ 9.3	45.3	1894	29.6	1885
Iowa.								
Cresco	25.2	22	35.7	+10.5	42.3	1878	19.6	1888
Kansas.								
Eureka Ranch	40.1	11	43.7	+ 3.6	46.6	1889	34.1	1891
Independence	44.5	22	50.6	+ 6.1	54.1	1878	36.7	1876
Louisiana.								
Grand Coteau	61.0	11	64.4	+ 3.4	66.2	1884	57.6	1892
Maine.								
Orono	27.5	23	32.5	+ 5.0	34.6	1871	19.1	1885
Maryland.								
Cumberland	37.1	23	44.9	+ 7.8	46.0	1878	30.0	1875
Michigan.								
Kalamazoo	31.3	18	41.3	+10.0	42.2	1878	22.5	1885
Missouri.								
Sedalia	41.3	11	48.8	+ 7.5	48.8	1894	36.1	1891
Montana.								
Fort Custer	32.5	12	28.4	− 4.1	40.8	1889	23.0	1888
Nebraska.								
Fort Robinson	34.0	10	36.9	+ 2.9	43.0	1889	24.8	1891
Genoa (near)	32.1	18	40.5	+ 8.4	43.6	1878	23.8	1876
Nevada.								
Browns	46.7	22	.....	.....	52.8	1879	37.7	1880
Carson City	41.3	17	40.8	− 0.5	50.1	1877	33.5	1880
New Hampshire.								
Hanover	27.8	23	35.9	+ 8.1	35.9	1894	19.0	1872, 1875
New Mexico.								
Fort Wingate	41.9	23	39.0	− 2.9	51.1	1879	34.3	1886
New York.								
Cooperstown	27.4	23	35.5	+ 8.1	37.2	1871	18.3	1885
Plattsburg Barracks	26.6	23	34.2	+ 7.6	35.0	1871	16.7	1885
North Carolina.								
Lenoir	45.5	20	52.0	+ 6.5	52.0	1894	35.0	1877
Oklahoma.								
Fort Reno	48.3	10	49.6	+ 1.3	52.8	1887	45.5	1891
Fort Sill	51.0	22	53.9	+ 2.9	59.3	1879	42.0	1876
Fort Supply	44.9	15	47.4	+ 2.5	52.6	1882	37.4	1876
Oregon.								
Bandon	46.8	10	45.5	− 1.3	50.8	1889	41.5	1886
Pennsylvania.								
Dyberry	28.6	23	37.7	+ 9.1	37.7	1894	19.5	1885
Grampian	30.5	23	39.8	+ 9.3	40.4	1878	20.1	1885
Wellsboro	30.5	14	39.4	+ 8.9	39.4	1894	22.4	1885
South Carolina.								
Statesburg	52.7	13	60.4	+ 7.7	60.4	1894	48.3	1885
South Dakota.								
Fort Sully	29.1	23	34.8	+ 5.7	44.5	1878	15.9	1876
Texas.								
Austin	60.4	22	.....	.....	66.8	1879	53.0	1872
Silver Falls	51.7	8	53.3	+ 1.6	57.6	1887	47.7	1891
Utah.								
Terrace	42.0	22	41.9	− 0.1	51.3	1889	28.3	1875
Vermont.								
Strafford	26.0	21	33.3	+ 7.3	33.8	1878	17.2	1883
Virginia.								
Dale Enterprise	41.5	14	47.2	+ 5.7	47.2	1894	32.1	1885
Washington.								
Fort Townsend	44.5	21	41.4	− 3.1	50.7	1885	38.7	1880
West Virginia.								
Parkersburg	41.7	12	47.3	+ 5.6	52.8	1882	36.7	1890
Wisconsin.								
Madison	29.3	23	38.3	+ 9.0	43.9	1878	23.2	1888
Wyoming.								
Fort Washakie	33.1	11	31.5	− 1.6	41.0	1887	26.8	1891

MONTHLY MEAN TEMPERATURE.

For the regular stations of the Weather Bureau the monthly mean temperature is the simple mean of all the daily maxima and minima; for voluntary stations a variety of methods of computation is necessarily allowed, as shown by the notes appended to Table II.

During March, 1894, the mean temperature was highest at Key West, Fla., 73.9, but lowest among United States stations at St. Vincent, Minn., 21.7, and among Canadian stations reporting by telegraph, 10.1, at Battleford, Saskatchewan. The temperature averaged 32 in a zone passing through central